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evidently did not belong to that species, as the body gradually diminished for the latter half "to the tail, which ended in a blunt point;" the "dorsal fin extended from the head to the tail;" "both sides of the fish were white, with four longitudinal bars of a darker color; the one immediately below the dorsal fin was about two inches broad, each of the other three about three-fourths of an inch. The side line straight along the middle." "Its head had been broken off and quite gone."

In all the points thus enumerated, the Scotch fish decidedly differs from the species of the genus *Lepturus*, and it is equally distinguished from the *Lepidopus caudatus* by its bars of color, the latter, like *Lepturus*, having uniform silvery sides. It is true that Hoy denies ventral and anal fins, but it must be remembered that he was not a scientific ichthyologist; the ventral scales, as well as the anal fin, had also, perhaps, been lost, or, preoccupied with the idea that his fish was the *Lepturus*; Hoy did not carefully look for them. But whether this hypothesis is right or wrong, it is evident that Hoy had neither a *Lepturus* nor *Lepidopus* before him, and another large species of the sea remains to be confirmed by British naturalists as a visitant to their waters. The third edition of Yarrell's work is unknown to me, but its rediscovery can scarcely be signalized in it, since no mention is made of it in the subsequent work of Günther.

The following table indicates the relative proportions of the *Evoxymetopon tæniatus*.

Extreme length 100.

Body—Greatest height 8; Height at anus $6\frac{1}{4}$; height of tail between anus and caudal fin 5; least height of tail $\frac{1}{2}$.

Head—Greatest length 12; distance from snout to nape 7; length of snout $4\frac{1}{4}$; length of operculum $4\frac{1}{4}$; length of lower jaw 5.

Orbit—Diameter 2; distance from profile $2\frac{1}{2}$.

Dorsal—Height at first spine 3; height at second spine $3\frac{3}{4}$; height at ray above anus $1\frac{3}{4}$; height at ray between anus and caudal $1\frac{1}{4}$.

Caudal—Length of external rays $3\frac{1}{4}$.

Pectoral—Distance from snout at upper axilla 14; length $6\frac{1}{4}$.

Ventral—Distance from snout $17\frac{1}{2}$; length $2\frac{3}{4}$.

Synopsis of the North American GADOID FISHES.

BY THEODORE GILL.

In this paper I have corrected some errors that were copied in the "Catalogue of the Fishes of North America," and an endeavor has been made to distribute the species, approximately at least, among their natural groups and genera. The whole family yet requires a careful revision, and the chief points to be cleared are rather referred to and indicated than elucidated. May those who are more fortunately situated carefully elaborate the subject!

I. Caudal fin distinct. Lateral line continuous.

A. Anterior dorsal fin developed as a true and separate fin.

B. Ventral fins normally developed, with (3—) five to seven rays.

1. Posterior dorsal, as well as anal, sinuated or emarginated behind middle. Vertebrae with their neural spines developed, and wedged one into the other. Frontal bones double..... MERLUCHINÆ.

* Teeth of inner row elongated, moveable..... Merlucius.

2. Posterior dorsal and anal fins double. Vertebrae with moderate neural spines .. GADINÆ.

a. Lower jaw longer. Barbel absent or rudimentary.

* Teeth of upper jaw of equal size..... Pollachius.

1863.]

- ** Teeth of upper jaw enlarged in the outer row. Boreogadus.
- β. Lower jaw shorter, received within the upper.
- * Head oblong conic and pointed; the snout at least twice as long as the eye. Chin barbel well developed.
- † Anterior dorsal little elevated. Mouth moderate, maxillary extending at least as far as front of orbit..... Gadus.
- †† Anterior dorsal elevated at angle. Mouth small, the maxillary not extending as far as orbit..... Melanogrammus.
- ** Head abbreviated; the snout blunt and little or no longer than the eye..... Brachygadus.
- 3. Posterior dorsal and anal fins entire and even.... LOTINÆ.
- * Anterior dorsal fin anterior, little behind the pectorals. Mandible and vomer with enlarged teeth..... Molva.
- BB. Ventral fins simple at their base, thence divided. PHYCINÆ.
- * First dorsal fin produced at third ray. Caudal fin convex behind..... Phycis.
- ** First dorsal fin rounded and not elevated. Caudal emarginated..... Urophycis.
- AA. Anterior dorsal fin composed of small fringes preceded by a slender ray..... CILIATINÆ.
- * Head depressed behind.
- α. Snout without cirrus..... Onos.
- β. Snout with cirrus..... Rhinonemus.
- ** Head compressed..... Ciliata.
- AAA. Dorsal fin single and extending on back..... BROSMINÆ.
- * Chin with a single barbel..... Brosmius.

Subfamily MERLUCINÆ Gill.

Genus MERLUCIUS Raf.

Onus Raf., 1810.
 Stomodon Mitchell, 1814.
 Hydronus Mindling, 1832.
 Merlus Gay.
 Homalopomus Girard.
 Epicopus Günther.

In North American waters are perhaps found two species of this genus occupying different areas: one, identified with the European species, inhabiting the seas of Greenland, and the *Merlucius bilinearis* occurring in more Southern latitudes.

MERLUCIUS VULGARIS Fleming.

Gadus merluccius Linn.
 Merluccius borealis Swainson.
 Hab.—Greenland.

I retain the name of Fleming for this species since there appears to be some doubt whether the one of the Mediterranean Sea and neighboring ocean is not different. I have never seen the Greenland species, and therefore am in no position to either confirm or contest its identification, which, however, is vouched for by the able Reinhardt.

MERLUCIUS BILINEARIS Gill.

Stomodon bilinearis Mitchell, Rep., p. 7, 1814.
 Gadus merluccius Mit.
 Gadus albidus Mit., Journ. Acad. N. S. Pa., i. p. 409.

[Sept.

Merlucius vulgaris Storer, Rep., p. 132.

Merlucius albidus Dekay, Rep., p. 280, pl. 46, f. 148.

Merlucius bilinearis Gill, Cat.

Hab.—Eastern coast from Virginia northwards.

This species appears to differ from the European hake by the more numerous rays of the first dorsal, the more depressed second dorsal and anal, and in its proportions. The number of rays given to the European species by some of the best zoologists is exhibited in comparison with that presented by the American species.

M. vulgaris.

D. 9—10 39—40	A. 37—39.....	Linnaeus.
D. 9 40	A. 39	Pennant.
D. 10—11 37—39	A. 37—38.....	Sundevall.
D. 10 39	A. 37	Parnell.
D. 9—10 39—40	A. 39—40.....	Kroyer.
D. 10	A. 39—40.....	Nilsson.
D. 10 36—37	A. 39—40.....	Günther.

M. bilinearis.

D. 12 39	A. 39.....	Mitch. Rep.
D. 12 38	A. 41.....	" Trans. N. Y.
D. 12 38—41	A. 40.....	Storer R. & Syn.
D. 11 39	A. 40.....	Dekay.
D. 13 41	A. 40.....	Storer Mem. Ac. vi.
D. 12 39 (d. 19)	A. 39.....	Gill.
D. 13 38 (d. 17)	A. 39.....	Gill.
D. 12 41 (d. 20)	A. 41.....	Gill.

From the above enumeration, it is evident that the difference in the number of the rays of the first dorsal does not come within the limits of specific variation. The depression of the second dorsal occurs at the seventeenth to twentieth rays. The number of rays of the first dorsal has been verified in eight other individuals.

Subfamily *GADINÆ* (Bon.) Gill.

Genus *POLLACHIUS* (Nilsson.)

This genus does not appear to include more than one American species, which one has been considered to be identical with the European *Pollachius carbonarius* by those who have compared the two. The *Merlangus poutassou* of Risso, referred to this genus by Nilsson and Bonaparte, is quite distinct from it and the type of one which, having received no special name, may now be designated *Micromesistius*; it is distinguished by its dentition, the very short abdomen, very long first anal and short second dorsal, which is widely separated from the first and third.

POLLACHIUS CARBONARIUS Bon.

Synonymy of American fish.

Gadus purpureus Mitch.

Gadus (*Merlangus*) *carbonarius* Rich., F. B. A., iii. p. 247.

Merlangus carbonarius Storer, Rep., 129.

" *purpureus* Storer, Rep., 130.

Pollachius carbonarius Gill, Cat., p. 48.

Merlangus purpureus Gill, Cat., p. 48.

Gadus virens Günther, iv. 339.

Doubtful synonymy.

Merlangus leptocephalus Dekay, Rep., p. 288, pl. 45, f. 146, (rectius 147 ?) 1863.]

I am acquainted with only one American species of this genus; it is undoubtedly the same described and figured by Storer in his *History of the Fishes of Massachusetts*, and the same as that which has been referred to the *Gadus virens*, or *Pollachius carbonarius*, by Dr. Günther. As that gentleman has identified it with the European species after an actual comparison of specimens from Boston and Europe, and, as Dr. Reinhardt has enumerated the European species among the Greenland Fishes, I am forced to follow them in faith until I shall be able to examine myself the fishes of the several countries.

I am, however, disposed to believe that the New England and New York type is a distinct species; in that case, it must receive the name *Pollachius purpureus*; the minute barbel is very often present.

Dr. Storer, in 1839, believed that he could recognize two species of *Merlangus* of the *M. carbonarius* type, one of which was called by the last name and the other designated as *M. purpureus*, Mitchill. In his descriptions he has given each a special set of characters, some of which are not mentioned in the description of the allied species, but, as his notices are not comparative, it cannot be assumed that the characters attributed to one are wanting in the other when not mentioned. But even after the eliminations required by such considerations, some points of his descriptions may be contrasted, and if implicitly relied in, would result in the admission of two species. Of *M. carbonarius*, he describes the "length of the head compared to that of the body, exclusive of the tail, as 1 to $2\frac{1}{4}$ "; depth of the body over the base of the pectorals rather less than the length of the head," while to *M. purpureus* is only attributed "a depth of the body across from the anus exclusive of the dorsal fin, as 1 to 4;" "length of the head about equal to the greatest depth of body;" the first dorsal fin of *M. carbonarius* is "longer than high;" in *M. purpureus*, a "third longer than high."

With regard to the proportions of the head and body of *M. carbonarius*, there can be no question that there has been error, for a length equal to two and a quarter times that of the head would nearly extend to the middle of the first anal,—proportions which the *M. carbonarius* of Europe certainly does not exhibit, and which, as subsequent evidence demonstrates, the *M. carbonarius* of Storer equally fails to show. The length of the first dorsal is exceptionally if ever a third longer than high. The other variations between *M. carbonarius* and *M. purpureus* are very slight, and no true specific characters are brought forward; and, as Storer has only admitted a single species in his last work on the Fishes of Massachusetts, there can "be little question that there is no specific difference between the two."

Dekay, subsequently, in his "Zoology of New York" admitted three species,—the *M. carbonarius* and *M. purpureus*, as well as a new species, which he called *M. leptocephalus*, distinguished by having the "lower jaw shortest," and of which he further says, "the upper jaw receives the under jaw within it, although, when extended, the latter appears somewhat the longest;" "the first dorsal pointed." His descriptions are, as usual, loose and vague, but, with the exception of the portions quoted above, contain nothing which would decidedly be opposed to their reference to the *M. carbonarius*, and if it is assumed, as from analogy would almost be justified, that the *M. leptocephalus* was founded on a specimen in which the lower jaw had been retracted by dislocation, they may with little hesitation be referred to one species.

In my Catalogue of the Fishes of the Coast, failing to exercise sufficient criticism, I have admitted the three species of Dekay and Storer's Synopsis, retaining the *M. purpureus* and *leptocephalus* in *Merlangus*, the latter being expressly said to have the lower jaw shortest, and Dekay's figure of *M. purpureus* representing the lower jaw still shorter,* (although opposed to his de-

* Have not Dekay's figures of *M. purpureus* and *M. leptocephalus* been reversed?

scription), while with Bonaparte the genus *Pollachius* has been accepted for *M. carbonarius*. I shall not attempt any justification of this error, as it undoubtedly is, for I myself entertain no doubt that all of the preceding names are referrible to one and the same species. Evidently the *M. leptcephalus* has no affinity to the true *Merlangi*.

In a moderately large specimen, the height is contained about 5 times in the extreme length, and $4\frac{3}{4}$ times to the point of the caudal peduncle; the head $4\frac{1}{2}$ times in the former, and 4 times in the latter. The first dorsal is about as high or higher than long and about two-thirds shorter than the second. The rays are indicated in the following formula:

D. (12—) 13 | 18—21 | 19—21. A. (21) 24—27 | 18—20.

Genus BOREOGADUS Günther.

BOREOGADUS POLARIS Gill.

Gadus æglifinnus Fab., Fauna Groenl., p. 142.

Merlangus polaris Sabine, App. Parry's Voyages, p. ccxi. 1824.

Gadus Fabricii Rich., F. B. A., p. 245; *Gthr.*, iv. p. 336.

Gadus polaris Rich., F. B. A., p. 247.

Gadus agilis Reinh., Vid. Selks. Afh., vii. p. 126.

Pollachius polaris Gill, Cat., p. 48.

Hab.—Greenland and Polar seas.

Dr. Günther has placed this species in a section of his genus *Gadus* named *Boreogadus*, and characterized by having the lower jaw longest; teeth in the outer series of the upper jaw stronger than the others. To it were referred the *Gadus fabricii* of Richardson (*B. polaris*), *G. Esmarkii* Nilsson, the *Merlangus productus* of Ayres, which belongs to the subfamily of Merlucciinæ, and has not the characters of the section; and, lastly, the *Gadus poutassou* of Risso which is the type of the genus *Brachymesistius*. The *Merlangus polaris*, however, is the type of a genus distinct from *Pollachius* and departs from that genus in its larger mouth, enlarged teeth of the outer row in the upper jaw, the extension forwards of the branchial aperture above, obsolescence of the lateral line behind and form of the pectoral fins. The single specimen which I have seen has also the caudal fin unequally lobed, the upper lobe narrowed and rounded behind, the lower triangular and angular; it is possible, however, that the peculiarity may not be normal, as no mention has been made of it by others.

Genus GADUS (Artedi) Bon.

Morrhua Cuv.

This genus, as now restricted, excludes the common Haddock and the *Gadus minutus* of Linnæus, the former of which is taken as the type of the genus *Melanogrammus* and the latter as that of the genus *Brachygadus*. The American species of *Gadus* have been involved in considerable confusion. There are two very distinct species found along the Eastern coast northwards to Hudson's Bay. One of these is at least nearly allied to the common cod of Europe, and has been known among modern American naturalists under the name of *Morrhua americana*; the second is the "tom cod" or "frost fish" of the people, and is quite distinct from any European species.

In addition to these, two other species have been attributed to America, both being inhabitants of the Greenland seas; one has been identified with the European cod, and the other has been named *Gadus ojac* and *ovak* by Richardson and Reinhardt, while by Günther it has been considered as a variety of the common cod.

Finally, Günther, on the authority of Mitchill, identifying the *Gadus morrhua* of that author with its Linnæan homonym, while referring the same author's *G. callarias* to the synonymy of *G. tomcodus*, has stated the true *G. morrhua* to be found southwards to New York.

1863.]

Having never seen any of the Greenland *Gadi*, I am unprepared to form an opinion of their distinction from each other or from the common cod of the more Southern American coast. I am, however, disposed to believe that Reinhardt has been able to find good characters for his *G. ovak*, while the cod of New England, the Gulf of St. Lawrence and Hudson's Bay appears to differ slightly from that of Europe by the proportions of the fins.

The specific differences between three of the species herein provisionally admitted remain to be confirmed.

GADUS MORRHUA Linn.

Gadus callarias Linn. (Young.)

Gadus callarias var. a. *Fabr.*

Morrhua vulgaris *Flem.*

Morrhua callarias *Cuv.*

Gadus morrhua *Reinhardt.*

Hab.—Greenland fide Reinhardt.

GADUS OJAC Richardson.

Gadus barbatus *Fabricius* (nec. Linn.)

Gadus ovak *Reinhardt.*

Morrhua ojac *Storer.*

Hab.—Greenland.

GADUS ARENOSUS Mitchill.

Gadus morrhua *Mitchill*, Am. Med. and Phil. Reg., vol. iv. 1814, p. 620.

Gadus callarias *Mitchill*, op. cit., pp. 620, 621.

b. *Gadus arenosus* " " "

c. *Gadus rupestris* " " "

Morrhua americana *Storer*, Rep., p. 120.

Gadus americanus *Gill*, Cat., p. 48.

Gadus morrhua pt. *Günther*, iv. p. 328.

The anus is under the first rays of the second dorsal fin, and is little nearer the snout than the point of the caudal peduncle. The first anal fin is quite or nearly half as long again as the first dorsal, about as long as the second, and about a fifth or fourth longer than the second anal. The supramaxillar ceases nearly at the vertical of the front of the pupil. The posterior nostril has an elevated margin. There are numerous minute pores on the head, on each side, six above the supramaxillar bones, the first linear and very near the margin of the snout, and four or five below and behind the eye; six or seven on each branch of the lower jaw, five along the margin of the preoperculum, five in the oculo-scapular groove, including the one above the angle of the branchial aperture, one between the anterior nostril and snout, one obliquely above the posterior nostril, and two on the nape above the second and third of the oculo-scapular groove. The caudal fin is slightly emarginated behind.

The proportion of the fins to each other are as follows, the fractions indicating the number of hundredths of the total length; the proportions of the same fins in *Gadus morrhua*, the first dorsal considered as the unit, are taken from Günther, and copied on the second line:

1st. D.	2 D.	3 D.	1 A.	2 A.
11—12	16—18	13—14	16—18	11—13
1	1.3	1.1	1.2	10.9.

The radial formula is as follows:

D. 13—15 | 19—22 | 19—22. A. 19—22 | 17—19.

The structure of the rays, is indicated in the following formula, where the first and last numbers of each fin refer to the simple articulated rays and the others to the branched or bifurcated:

D. 2. 7. 4 | 2. 12. 3 | 2. 14. 3. A. 2. 14. 3 | 2. 14. 1.

[Sept.

The rays of the specimens, whose measurements are given, are herewith indicated.

N. Foundland	D. 13	22	22	A. 22	20
Labrador	13	18	19	19	19
Hudson's Bay	13	17	19	19	17

The more detailed measurements of these specimens are given in the following table, and are taken from specimens of equal size, scarcely more than a foot long. The first one was obtained by the author at Newfoundland; the second at Labrador, by Dr. Elliott Cones, and exhibits the monstrosity of two barbels, one behind the other; the third was obtained at Hudson's Bay by Mr. Drexler, and has unusually long pectoral and ventral fins. Notwithstanding these deviations of the last two, on account of which they were selected, they nearly agree in most of the measurements.

Extreme length (=100).....	12½	12½	12½
Body—Greatest height.....	18	18	15½
Height of tail behind second dorsal fin.....	12	10	9
Least height of tail.....	5	4½	4
Length of tail.....	?	12	11
Head—Greatest length.....	26	26½	26
Greatest width.....	12	11½	11½
Width of interocular area.....	6½	6	6½
Height at nape.....	15	15	14
Length of snout.....	8½	9½	9
Length of operculum.....	5	5	5½
Length of supramaxillar.....	9½	10½	11½
Orbit—Diameter.....	5½	5½	5½
Dorsal (First)—Distance from snout.....	29	30	31
Length of base.....	11½	11	12
Greatest height.....	12	13½	14½
(Second)—Length of base.....	18	16½	16
Greatest height.....	10	10	11½
(Third)—Length of base.....	14	13	13
Greatest height.....	9	10	10½
Anal (First)—Distance from snout.....	45½	47½	47
Length of base.....	18	15½	17½
Height at longest ray.....	11½	12½	11
Caudal—Length of middle rays.....	7	7	8
“ “ external rays.....	11	11	12
Pectoral—Length.....	13	13½	16½
Ventral—Length.....	12	12	15½

GADUS TOMCODUS Walbaum.

Gadus tom-cod Walbaum, *Artedi*, p. 133, 1792.

Gadus pruinosisus Mitchell, Rep.

Gadus tomcodus Mitchell, *Am. Med. and Phil. Reg.*, iv. 1814, pp. 621, 622.

(b.) *G. t. fuscus* “ “ “ “ “ “

(c.) *G. t. luteus* “ “ “ “ “ “

(d.) *G. t. luteo-pallidus* “ “ “ “ “ “

(e.) *G. t. mixtus* “ “ “ “ “ “

Gadus pruinosisus “ “ “ “ “ “

Gadus polymorphus “ “ “ “ “ “

Morrhua (tomcodus) Cuv., R. A.

Morrhua tomcodus Storer, Rep.

Morrhua pruinosa DeKay.

The anus is under the last rays of the first dorsal fin and is nearly midway between the snout and the axil of the anal fin. The first anal is about twice as long as the first dorsal, about a third longer than the second, and nearly or 1863.]

quite twice as long as the second anal. The supramaxillary bone ceases at a vertical drawn nearly midway between the front of the eye and pupil. The pores of the head are obsolete. The caudal fin is convex behind.

Hab.—New York to Newfoundland.

The preceding diagnosis at once distinguishes the “*tom-cod*” or “*frost fish*” of the Americans from the common cod, and, although the distinctive characters may not have been very well indicated in the diagnoses or descriptions of American naturalists, there has been no confusion between them and there has never been difficulty in practically distinguishing them. European naturalists have been less fortunate: Dr. Kaup placing the name of the tom-cod among the synonyms of *Gadus morrhua* and also including under the latter the *Morrhua americana*, while Dr. Günther, although well distinguishing the *Gadus tomcodus*, has been unhappy in the distribution of the synonymy. The *Gadus callarias* of Mitchill is the same as his *Gadus morrhua* and both are identical with *Morrhua americana* of Storer and Dekay; the former and latter names must therefore be withdrawn from the synonymy of *G. tomcodus*, to which they have been referred by Günther, and with the *G. callarias* must be placed at least provisionally as the synonyms of a close analogue of the European cod. The figure of Dekay might have informed naturalists that the *M. americana* was not the same as the “*tom-cod*.” A good figure of the American cod is also given by Dr. Storer in his “History of the Fishes of Massachusetts” in the “Memoirs of the American Academy,” (2d ser.) vol. vi. (p. 343) pl. xxvii. fig. 4.

Genus BRACHYGADUS Gill.

Brachygadus Gill, Proc. Acad. Nat. Sci., Pa., 1862.

Type. *Gadus minutus* L.

BRACHYGADUS MINUTUS Gill.

Gadus minutus Linn.

? *Morrhua minuta* Storer, Reports on the Ichthyology and Herpetology of Mass., p. 127, 1839.

“ *Morrhua minuta* Dekay, Zoology of New York, *Fishes*, p. 277 (fig. 141 altered from Yarrell), 1842.

This species, or even an allied one, has not yet been permanently established as even a visitant of the North American waters. Dr. Storer, in his Report, mentions a single specimen “which was taken in Boston harbor; it has been preserved several years in spirits in the Boston Society of Natural History,” and “its colors have undoubtedly somewhat changed.” The specimen was “eight inches in length; length of the head two inches; depth of the body across the base of the pectorals rather less than the length of the head;” “snout obtuse;” “a cirrus one-fourth of an inch long is suspended from the chin;” eye half an inch in diameter, being equal to one-fourth the length of the head; “the pectorals are an inch long.” D. 12—19—17. P. 17. V. 6. A. 22—17. C. 20.

Such is the only notice of the existence of the *Brachygadus minutus* on our coast. The description is scarcely reconcilable with the European species; and almost the only character which would indicate that it might not be the young of *Gadus americanus* is the “snout obtuse,” but when the “*Morrhua tomcodus*” is said to have the “snout blunt,” it may be asked, what is meant by that term? and if there is any difference between the two?

Dekay also inserted the “*Morrhua minuta*” among the fishes of New York, compiling his description from Yarrell and Storer, giving the radial formula of the latter and copying, with alterations, the figure of Yarrell. He finally stated:

“This is a rare species on our coast. I only know it through the description of Dr. Storer, although I think I saw it some years since in the market.

[Sept.

At that time, I supposed it might be the *M. pruinosa*, var. *fusca*, of Dr. Mitchell, but I have now little doubt but that it was the species just described."

Dr. Storer, in his "Synopsis," gave a diagnosis attributing a "depth one-fifth of the length; first dorsal entirely before the first anal;" copying the radial formulæ of Jenyns, Yarrell and himself, giving only "Massachusetts" as its habitat, but admitting Dekay's notice in his synonymy.

In his "History of the Fishes of Massachusetts," he takes no notice whatever of the species, and does not quote his notice among the synonyms of "*Morrhua americana*" or "*M. pruinosa*."

Finally, in consideration of the uncertainty at least in which the existence of this species as an American fish is concerned, it must be eliminated from the Fauna of the coast until definitely established, and the name of Storer will probably be placed in the synonymy of *Gadus americanus*.

Genus MELANOGRAMMUS Gill.

Melanogrammus Gill, Proc. Ac. N. S. Phila., 1862.

The genus *Melanogrammus* is sufficiently distinguished from *Gadus* by its smaller mouth, the produced first dorsal fin, black lateral line and the development of the humerus.

Nilsson* and Bonaparte† have expressly appropriated the Artedean name *Gadus* for the *G. morrhua* and its allies, most judiciously treating the Cuvieran genus *Morrhua* as its synonym, since, as its name indicates, the latter was intended to embrace the common cod as its type; the *G. æglifinus* at the same time was removed from the genus and referred to the genus *Merlangus*, which was differently limited and otherwise defined than by Cuvier. Finally, perceiving that it was not a true *Merlangus*, and agreeing with Nilsson, Kroyer and Bonaparte in its separation from *Gadus*, I have, in an article published in the Proceedings of the Academy of Natural Sciences, for June, 1862, distinguished it under the generic name *Melanogrammus*, which must be, of course, retained by those who consider the genus a valid one.

MELANOGRAMMUS ÆGLIFINUS Gill.

Gadus æglifinus Mitchell.

Morrhua æglifinus Storer.

Hab.—Eastern coast from New York northwards.

I have been unable to compare this American fish with the European species, and before considering the identification definite, a careful comparison is necessary, especially since it has not been found in Greenland.

Subfamily PHYCINÆ (Sw.) Gill.

Genus PHYCIS Raf.

There are specimens of two very distinct species of the restricted genus *Phycis* in the collection of the Smithsonian Institution, and to those two I am inclined to refer all the names given by authors to the American specimens. Concerning the nomenclature of the two, there is as usual some confusion. This I shall endeavor at least in part to dissipate.

PHYCIS CHUSS Gill.

Blennius (chuss in New York) *Schæpf*, Ges. Nat. F. zu Berlin, viii. p. 143, 1788.

Blennius chuss Walbaum, p. 186, 1792.

Enchelyopus americanus Schn., Bl., p. 53.

Gadus longipes Mitch. op., cit., iv.

Phycis (americanus) Cuv., R. A., 1817, ii. 217.

* Nilsson, Prodrum Ichthyologiæ Scandinavicæ, 1832, pp. 39, 41.

† Bonaparte, Catalogo Metodico dei Pesci Europei, 1846, p. 45.

Phycis americanus Dekay, Rep., 291, f. 159.

Phycis americanus pt. Storer, Sys., 221.

Phycis tinca Kaup, Arc. f. Nat., 1858, i. 89.

Phycis filamentosus Storer.

The height at the anus enters about $6\frac{3}{4}$ times in the extreme length and 6 times exclusive of the caudal fin; the head more than 5 times in the former or $4\frac{1}{2}$ in the latter. The supramaxillar bones end under the posterior margin of the pupils. The snout is longer than the eye and forms a quarter of the head's length. The width of the interorbital space exceeds the vertical diameter of the orbit.

The vent is nearly under the tenth ray of the second dorsal, generally intermediate between the snout and about the end of the fourth or fifth of the anal fin. The elongated third dorsal ray is generally shorter than the head. The pectoral enters about $1\frac{1}{3}$ times in the head's length. The ventral is more than a half larger than the head and extends behind the vent.

The scales are very distinct, in about 110 oblique rows from the scapular region to the end of the caudal peduncle, and in nine rows between the first dorsal and the lateral line.

D. 9 | 57. A. 50.

The color of the body and fins is yellowish-brown, thickly punctulated with darker. The anal has its rays tipped with white, by which a whitish linear margin is produced. The roof of the mouth and most of the tongue is dark purple.

The first notice of this species appears to have been given in Schœpf's Descriptions of some North American Fishes, published in 1788. He there describes a fish under the generic name of *Blennius*, which, according to him, was called "*chuss*" at New York. The color was reddish-brown on the head and back, white beneath; in a specimen eighteen inches, the shorter branch of the ventral ray was $2\frac{1}{2}$, and the other 5 inches long; the first dorsal had nine rays, of which the first (truly third) was filiform and four inches long; the second dorsal had 60 rays, and the anal 53; the scales were deciduous.

This description was paraphrased from the German, except in the important notice of the proportions of the ventral fins, by Walbaum in his edition of Artedi, and he was the first to confer a specific name—*Blennius chuss*—on it.

Mitchill, in 1814, under the name of *Gadus longpipes*, gave a recognizable description of it based on a specimen having the "length about twenty inches; depth three and a half: the first (third) ray of the first dorsal almost six inches long." Allusion was made to the "sides of the tongue and inside of the throat smutty or dotted with black." "The ventral fins (were) six inches long, bifid, tapering and reddish."

Storer, in his, "Report on the Fishes of Massachusetts," has confounded this species with another, for which he has retained the name of *P. americanus*. In his "Synopsis of the Fishes of North America," he has repeated his error, citing the description and figure given by Dekay of the present; but his description in the latter work was so vague that I was not aware of it till the publication of his History.

Finally, in his "History of the Fishes of Massachusetts," Storer has described and figured the present species under the new name of *Phycis filamentosus*, while the *P. americanus* proves to be quite different from that on which the latter name was originally conferred.

PHYCIS TENUIS Dekay.

Phycis furcatus Storer, Boston Journ. N. H., i. 418 (excl. syn.)

Phycis americanus Storer, Rep., p. 138 (excl. syn.)

Doubtful synonymy.

Gadus tenuis Mitch.

Phycis tenuis Storer, Syn., 222.

Phycis Dekayi Kaup, Archiv. f. Nat., 1858, i. p. 89.

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The height at the anus enters nearly six times in the extreme length, and five times to the rudimentary caudal rays; the head about $4\frac{1}{2}$ — $4\frac{3}{4}$ in the former, and 4 — $4\frac{1}{2}$ without the caudal. The supramaxillary bones end under the posterior margin of orbit. The snout is longer than the eye, and forms a fourth of the head's length. The width of the interorbital space equals the vertical diameter of the eye. The snout is narrower and more pointed than in *P. chuss*.

The anus is under the ninth to the eleventh rays of the second dorsal fin, and is nearly intermediate between the snout and constricted portion of caudal peduncle. The elongated third dorsal spine about equals the distance from the snout to the upper angle of preoperculum. The pectoral enters about $1\frac{2}{3}$ times in the head's length. The ventral little exceeds the head, and rarely extends to the vent.

The scales are small; there are 135 to 140 oblique rows extending from the scapular region to the end of the caudal peduncle; there are twelve rows between the origin of the first dorsal and the lateral line, and ten between its end and the line.

D. 10	54	A. 46.
9	57	A. 47.
10	58	A. 50.

The color is brownish, lighter and suffused with yellowish below the lateral line, and with the belly almost yellow. The fins are very dark. The interior of the mouth is simply sparingly punctulated with blackish.

The name of *Phycis tenuis* is connected with this species, as the latter agrees with its description in having "brown back and sides," the fins "dark brown, save the ventral," the rays approximately. "D. 11. 54. A. 44." But it is necessary to recall that the *Gadus tenuis* is said to have the "throat internally streaked with red and purple. Vent nearer the head." The latter, however, as will be seen from other descriptions by Mitchill, has been used at random, and, with the not unusual vagueness of Dr. Mitchill, in an absolute and not relative sense; as to the other character, I have not noticed it in any specimen of *P. chuss*, and it is quite possible that the dark purple dots of the present species may assume a "streaked" arrangement on the reddish ground of the throat. The color and radial formula militate against the idea of its identity with the *Gadus longpipes* (= *Phycis chuss*), immediately afterwards described by Mitchill, and we may also take into consideration, but without assigning to it undue value, the improbability of the description under two names at the same time of so characteristic a species as the *P. chuss*. For the present, therefore, I venture to present the species in question under the name of Mitchill. It is true that the identification is not positive, but not less uncertainty would prevail in connection with the name of *P. Dekayi* hereafter noticed.

In the "Report on the Fishes of Massachusetts," Dr. Storer has given a description of the species under the name of *Phycis americanus*; in his Synopsis, a vague notice under the same name, nearly applicable to each, but with the synonymy of the true *P. americanus*; and, finally, in his "History of the Fishes of Massachusetts," he has again described and well figured the same species under the same name, giving a new one to the true *P. americanus* which had been then recently discovered on that coast.

In the "Archiv für Naturgeschichte" for 1858, Dr. Kaup has briefly noticed a species from North America, similar to the "*P. tinca*" (*P. chuss*), but with a longer snout, higher body, and considerably smaller scales, D. 10. 54. A. 47; this portion of the description, so far as it goes, is applicable to the present species, and was, doubtless, based on representatives of it. He places the species, however, in a section distinguished by having the ventral fins, nearly or quite twice as long as the head, and, if this statement is literally applied, Kaup's

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species can scarcely be the same as the one in question, but it is probable that we should take his diagnosis with some latitude.

A reference to the species recently described by Dr. Günther from two specimens in the British Museum, under the name *Phycis rostratus*, may be here appropriate. The habitat of the species is unknown; it was suggested that the specimens ought, perhaps, to be referred to *P. americanus*, (= *P. chuss*), "but that species appears to have considerably longer ventral fins." "*P. Dekayi*", briefly noticed by Kaup, is stated to have the body more elevated than *P. americanus*; and the ventrals, nearly or quite twice as long as the head."* The lateral line of *P. rostratus*, has about 150 scales, and there are "ten series of scales between the anterior dorsal and the lateral line;" "the ventral extends the origin of the anal," but yet is "not much longer than the head." The specimens are eight inches long, or about the same size as those of *P. tenuis*, here described. From this notice, *P. rostratus* appears to differ from either of the two here enumerated. It remains, however, to ascertain whether it is an American fish, and then whether it is not Mitchell's *Gadus tenuis*.

Genus UROPHYCIS Gill.

UROPHYCIS REGIUS Gill.

Blennius ——— *Schæpf*, Ges. N. F., viii. pt. 2, p. 142.

Blennius regius *Walbaum*, Art., p. 186, 1792.

Echelyopus regalis *Bl. Schn.*, p. 53, 1891.

Gadus blennoides *Mitch.*, Med. and P. Reg., iv. p. 1814.

Gadus punctatus *Mitch.*, op. cit., iv.

Phycis punctatus *Dekay*, N. Y. F., p. 292, pl. 46, f. 149, 1842.

Phycis regalis *Kaup*, Arch. f. Nat., 1858, i. p. 89.

Hab.—New York.

Subfamily LOTINÆ Gill.

Genus MOLVA (Flem.) Nilsson.

MOLVA VULGARIS Fleming.

Gadus molva *Fabr.*, Faun. Groenl., p. 148.

Lota molva *Storer*, Syn.

Hab.—Greenland.

Greenland representatives of this genus have been identified by European naturalists with their *Molva vulgaris*. I am not acquainted with the American type, except through such sources.

Subfamily CILLIATINÆ Gill.

Genus ONOS Risso.

Les Mustèles *Cuv.*, R. A., 1817, ii. 215.

Onos *Risso*, Eur. Merid., iii. 214, 1827.

Mustela *Stark*, Ed. 1, p. 425, 1828.

Gadus *Fleming*.

Bonaparte quotes the *Gaidropsarus mustellaris*, of Rafinesque, among the Synonyms of his *Mytella mediterranea*, which is the *M. tricirrata* of authors. Rafinesque gave the following diagnosis of the genus and species in the "Indice d'Ittiologia Siciliana:"

"Genere *Gaidropsarus*. Piv di un raggio all' ale giugulari, due ale dorsali, la seconda delle quali è reunita coll' ala caudale, e con l'anale "*Gaidropsarus mustellaris*. Quattro barbette, due alla mascella superiore, e due all' inferiore, ale giugulari con due raggi inuguali.—*Sinonimia, Mustella Rondelet, lib. 9, cap. 16, fig.*"

* The statement of the length of the ventrals is in the diagnosis of a section (a) of the genus.

As the *Motella tricirrata* has five-rayed ventral fins, the second dorsal not united with the caudal and anal, and only one barbel to the lower jaw, and thus has only one character of least importance mentioned by Rafinesque, I am not prepared to accept his name for the genus, although he quotes the figure of Rondelet. The French name of Cuvier cannot be retained, and Risso's comes next in order.

Two species are found in North America which represent European ones, and are very closely related to their respective analogues.

ONOS REINHARDII Gill.

Motella mustela Reinhardt, Kong. Dansk. Vid. Selks. Nat. og Math., vol. vii. pp. 115, 128.

Motella Reinhardi Kroyer.

Hab.—Greenland.

Closely related to the *O. mustela* of Europe, and agreeing in having five barbels, one to each nostril and one at the chin.

ONOS ENSIS Gill.

Motella ensis Reinh., op. cit., vol. vii. pp. 115, 128.

Hab.—Greenland.

Very closely allied to the *M. tricirrata* Nils., and like it provided with three barbels, one at each anterior nostril and one at the chin.

Genus RHINONEMUS Gill.

RHINONEMUS CAUDACUTA Gill.

Motella caudacuta Storer, Proc. Boston, vol. 1848, p. 5; Mem. Am. Ac.

Motella cimbria? *Bell*, Canadian Nat. and Geol., vol. iv. p. 209, 1859.

Hab.—Massachusetts to Gulf of St. Lawrence.

Very closely related to the *Motella cimbria* of Europe, but has "the posterior margin of the second dorsal and anal fins, as well as the edge of the caudal fin, of a dark slate color," and D. 53. A. 48.

Genus CILIATA Couch.

Couchia Thompson.

CILIATA ARGENTATA Gill.

Motella argentata Reinhardt.

Couchia argentata Günther, ii. 363.

Hab.—Greenland, (Reinhardt;) and Nahant, Mass., (Dr. J. H. Slack.)

Subfamily BROSMINÆ Gill.

Genus BROSMIUS Cuv.

The American species of this genus are involved in some uncertainty. Although attributed to Greenland, it is at least nearly certain that the European *Brosmius brosme* is not found in our southern waters, but it is not, perhaps, quite clear what name the American analogue shall bear. Lesueur has described and figured a species from Marblehead, to which he gives, both in his description and figures, a protuberant lower jaw and a double barbel; it has been named *Brosmius flavesny*, and is stated to be salted like the common cod, much esteemed as food, and to be rare on the banks of Newfoundland. No specimens with the characters noticed have since been obtained, and, if only the double barbel had existed, it might not have been impossible that Lesueur had obtained a single specimen of the common cusk, which exhibited such abnormal characters, the duplication of the barbel having been noticed in a specimen of the *Gadus arenosus* already referred to. Such, however, appears to be highly improbable, for it is not simply a double barbel which characterizes it, but at least, in addition thereto, a longer lower jaw 1862.]

and a more advanced dorsal fin. These will all have to be reconciled or explained away, before Lesueur's name can be adopted for the common cusk.

By Dr. Storer, the Lesueurian name was first unequivocally appropriated for the common *Brosmius*, and this was done without any notice of the discrepancies between the characters mentioned by Lesueur and those exhibited by his specimens. Yet the latter were described, and one figured by Storer, with "a single barbel," "the upper jaw slightly longer than the lower," and the dorsal commencing "on a line above the anterior half of the pectorals." Until it is demonstrated, or rendered nearly certain, that no species exhibiting the characters in a normal condition mentioned by Lesueur exists on our coast, it is not allowable to so apply his name, and, consequently, a new one is required for the *Brosmius flavescens* of Storer.

BROSMIUS BROSMÆ White.

Gadus brosmæ Fab., quasi Müll.

Brosmius vulgaris Reinh., quasi Cuv.

Brosmius brosmæ pt. Gill, Cat.

Hab.—Greenland.

I only know this species as a Greenland fish through the works of Fabricius and Reinhardt.

BROSMIUS AMERICANUS Gill.

Brosmius vulgaris Storer, Rep., 136.

Brosmius vulgaris ? Dekay, p. 289, (not fig.)

Brosmius flavescens. Storer, Syn., 221.

Brosmius brosmæ pt. Gill, Cat., 49.

Hab.—New England coast northwards to Newfoundland.

BROSMIUS FLAVESCENS Les.

Le Brosme jaune Les., Mem. Mus., v. p. 158, pl. 16, (mid. fig.) 1819.

Brosmius flavesny " " " " " " " "

Brosmius flavescens Günther, iv. 369.

Hab.—Massachusetts and banks of Newfoundland.

Descriptions of the Genera of *GADOID* and *BROTULOID* FISHES of Western North America.

BY THEODORE GILL.

The object of the present article is more especially to give the characters of the genus *Gadus* as recently restricted, to develop the characteristics and unravel the synonymy of the genus *Merlucius*, concerning which, and particularly the Californian representatives, considerable confusion exists, and to elucidate the genus *Brosomphycis*.

I am disposed to believe that Günther is correct in separating from the family of Gadoids the group of genera which he has called *Brotulina*, but it is more than questionable whether he is right in referring to, and combining in, the same family his groups *Ophiidina*, *Fierasferina*, *Ammodytina* and *Congrogadina*. It is quite true that Dr. Günther has been unable to find any one character to separate his families Gadidæ and Ophidiidæ, and that he has entirely based them on the different combinations of characters, but it is at the same time probable that they will be eventually found to be distinguishable by true family characters, based on anatomical differences, such as the form of the cranium, maxillary bones, intestinal canal, &c. The distinctive characters which Günther has employed for his families are the following :

GADIDÆ with "ventral fins composed of several rays, or, if they are reduced to a filament, the dorsal is divided into two. Either the caudal free

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